REMARKS/ARGUMENTS

Favorable consideration of this application is respectfully requested.

In the present amendment, Applicant has amended independent claim 8, canceled claims 9-17 and added new claims 18 and 19. Support for amendments to Claim 8 and new claims 18 and 19 is found in the specification at page 3, lines 20-27; the entire Fig. 1; page 4, lines 15-21; page 5, lines 15-19. No new matter has been added.

Turning now to the Claim Rejections in the Office Action of February 21, 2008, on page 2, paragraphs 1, 2 and 3 state the statutory, case law and Examiner's basis for the rejection of Claims 8 and 10-12 under 35 U.S.C. 103(a) as being unpatentable over Iwasaki et al (US 6,838,297) in view of Urayama et al (US 6,650, 061) in view of Weinberg et al (US 6, 638,413).

On page 4, paragraph 4, Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Iwasaki et al (US 6,838,297) in view of Urayama et al (US 6,650, 061) in view of Weinberg et al (US 6, 638,413) as applied to claim [1] above, and further in view of Bell (US 4,310,393).

On page 5, paragraph 4, Claims 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwasaki et al (US 6,838,297) in view of Urayama et al (US 6,650, 061) in view of Weinberg et al (US 6, 638,413) in view of Bell (US 4,310,393).

Applicant prefaces the remarks and arguments herein by pointing out that the cancellation of claims 9 -- 17 render the rejections of these claims moot and therefore, Applicant respectfully requests the withdrawal of the rejection of claims 9, 10-12, 13-17 under 35 U.S.C. 103(a) as being unpatentable over varied combinations of Iwasaki et al (US 6,838,297) in view of Urayama et al (US 6,650, 061) in view of Weinberg et al (US 6, 638,413) in view of Bell (US 4,310,393).

Prior to discussing the Examiner's rejections of Claim 8 as being unpatentable over Iwasaki et al in view of other references deemed appropriate by the Examiner, Applicant's amendments have removed the functional language not appropriate for the description of the apparatus and are believed sufficient to distinguish the present invention from the prior art by providing the details of an electrochemical deposition apparatus for producing carbon nanoparticles having a plurality of electrodes, including an anode and a cathode made of silicon wafer material coated with catalytic nanoparticles and liquid hydrocarbon bath and a power supply providing direct current. [*Underlining added for emphasis.*] Neither reference alone or in combination discloses or suggests Applicant's apparatus.

It was not known prior to Applicant's invention that an electrochemical deposition apparatus with catalyst coated electrodes in a liquid hydrocarbon bath of methanol and benzyl alcohol would produce carbon nanoparticles with the application of a direct electrical current. The apparatus is now disclosed and claimed in amended claim 8 and new claims 18 and 19.

In paragraph 3 of the Office Action of February 21, 2008, the Examiner rejects claim 8 under 35 U.S.C. 103(a) as unpatentable over Iwasaki et al. (U.S. Patent 6,838,297) in view of Urayama et al (U.S. Patent 6,650,061) in view of Weinberg et al (US 6,638,413). The Examiner argues that Iwasaki et al discloses an apparatus for producing *nanostructures* (nanotubes) comprising the components of: ...a temperature controlled electrochemical bath, electrolyte, reaction vessel... electrode/substrate, ...cathode... and admits that Iwasaki ..."fails to explicitly disclose coating the electrodes, anode and cathode with catalytic nanoparticles of iron and nickel in said container." Also, on page 3 of the Office Action of February 21, 2008, the Examiner admits that "...Iwasaki et al fails to expressly describe a power supply for imposing a direct current of approximately 1000 volts."

Applicant respectfully disagrees with the Examiner's characterization of the teachings in Iwaskai et al. First, Iwasaki forms a ***nanostructure*** from anodized film with nanoholes cut through the anodized film on a semiconductor surface that can include carbon; that is not equivalent to the apparatus, used by Applicant to produce *carbon nanoparticles* in a liquid phase under ambient conditions. Secondly, the nanostructure by Iwasaki is obtained by anodizing aluminum. See Iwasaki et al '297 column 1, lines 12-13, and column 28, Claim 1. In contrast, Applicant's apparatus produces **carbon nanoparticles** by electrolysis of liquid hydrocarbons.

Even Iwasaki's method for producing nanoholes described in columns 7 and 8, beginning at line 24, discusses anodizing aluminum film using various types of electrolytes that are inorganic acids. In contrast, Applicant uses an organic solution of methanol and benzyl alcohol as the liquid bath in the electrochemical reaction apparatus; the organic solution is essential to the formation of carbon nanoparticles.

In column 19 lines 15-42, Iwasaki et al describe the formation of carbon nanotubes in "a solution consisting of 5% $CoSO_4.7H_2O$ and 2% H_3BO_3 employed as a plating bath and the electro-deposition was performed for 1 sec under application of an **AC** [*underlining and bold type used for emphasis*] voltage of 5 V.

Subsequently, the sample was heated at 700°C for 1 hour in a mixed gas of 2% C_2H_4 (methane) and 98% He (helium), so that carbon nanotubes were grown from the catalytic ultra-fine particles... extending outward from inside of the nanoholes..."

In summary, Iwasaki produces ***anodized aluminum nanostructures***; whereas, Applicant produces ***carbon nanoparticles***. Iwasaki uses an *inorganic* electrolyte; while Applicant requires the use of an *organic* electrolyte solution. Iwasaki uses alternating current (AC) in the electrochemical process; whereas, Applicant uses direct current. Iwasaki uses temperatures in a range of 700° C; Applicant uses ambient conditions (10-30° C). Applicant's apparatus claims have been amended to claim these patentably distinct features.

The Examiner argues that some of the deficiencies in Iwasaki et al are overcome in view of Urayama et al. stating that "Urayama et al describes the formation of carbon nanotubes (See column 6, lines 22-50) wherein the conductive layer ... of the electrode wire... can be iron and nickel in order to facilitate lower processing temperatures and selective growth provided by catalytic action..."

Applicant respectfully disagrees with the Examiner's interpretation of the teachings of Urayama. First of all, Urayama, column 6, lines 22-50 there is NO discussion or teaching regarding the purpose for selecting iron and nickel. The discussion regarding the function of "a transition metal" is found in column 7, lines 29-35 and will be discussed below.

Meanwhile, column 6, lines 22-50 reads in part: "In the case when the emitter **6** is constituted by carbon nanotubes, the conductive layer ***2c*** is preferably made from a material that exerts a catalytic action upon forming the carbon nanotubes, or a mixture having such a material as a main component. Thus, the conductive layer ***2c*** is properly selected from metal layers made of any metal selected from the group consisting of metals of the iron family such as iron, nickel and cobalt,..." This only teaches that a conductive layer **2c** is made of metals, including iron and nickel. Column 6, lines 22-50 also teach that the conductive layer of Urayama is part of several layers in a cathode electrode wire: ***2a*** is a cathode electrode layer, ***2b*** is a ballast resistance layer, ***2c*** is a conductive layer. The use of a three-layered cathode electrode wire does not suggest to one of ordinary skill in the art to choose just one of the three layers to form catalytic nanoparticle coatings for an anode and a cathode in an electrochemical deposition apparatus.

With regard to the Examiner's argument that Urayama teaches "... the conductive layer ... of the electrode wire... can be iron and nickel in order to facilitate lower processing temperatures and selective growth produced by catalytic action...," in column 7, lines 29-35 of Urayama et al, is discussing the formation of a cathode electrode layer, stating that "a transition metal, ... having a catalytic action, such as iron, makes it possible to provide the following effects: a low formation temperature, a reduction in structural defects in the carbon nanotubes, and a selective growth at necessary portions." This statement follows a sentence regarding filling pores with carbon nanotubes **not producing carbon nanotubes.** Thus, the teaching attributed to Urayama is taken completely out of context; Urayama et al teach the preparation of an electron-source array composed of cathode electrodes, gate electrodes arranged to intersect with each other to form pores filled with a conductive material, which happens to be a transition metal – nickel or iron.

In Urayama et al, column 8, lines 30-35, the production of carbon nanotubes is discussed as follows: "After the formation of the pores..., ethylene and hydrogen, which are materials of carbon nanotubes, are allowed to flow in the plasma CVD process so as to form carbon nanotubes in the pores; however, the growth is completed at a level in which the tip of the carbon nanotube is maintained slightly lower than the alumina surface..." This would certainly suggest to a person of ordinary skill in the art that Urayama et al. use the *chemical vapor deposition* (CVD) process to produce carbon nanotubes.

Applicant further disagrees with the Examiner's argument that "It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the conductive layer in Urayama et al for coating the electrodes of Iwasaki et al inorder to facilitate lower processing temperatures and selective growth provided by the catalytic action." Neither Iwasaki et al ,who teach the preparation of anodized aluminum nanostructures with irogranic electrolyte solution, nor Urayama et al who use *chemical vapor deposition* to produce carbon nanotubes, in combination or alone, suggest, teach or motivate one to make an electrochemical deposition apparatus with catalyst coated silicon wafer electrodes in a liquid hydrocarbon bath of methanol and benzyl alcohol to produce carbon nanoparticles with the application of a direct electrical current.

With regard to the newly cited Weinberg et al reference, the Examiner argues that "Weinberg describes an electrochemical cell… wherein 1000 volts of direct current are applied to the cell in order to provide short pulse durations. …It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the power supply in Weinberg et al in the apparatus of modified Iwasaki et al. in order to provide short pulse durations."

Applicant objects to the citing of Weinberg et al as a reference against this invention. Weinberg discloses a method and apparatus for hydrolyzing water in an electrochemical cell. Weinberg is producing oxygen, hydrogen and heat NOT **carbon nanotubes**. The Examiner uses prohibited hindsight in selecting a method and apparatus for the electrolysis of water to select a feature (1000 volts of direct current) that is missing in the other cited references. In *In re Nomiya,* 184 USPQ 607 (CCPA, 1975) the court held, "There must be a reason apparent at the time the invention was made to the person of ordinary skill in the art for applying the teaching at hand, or use of teaching as evidence of obviousness will entail prohibited hindsight."

Thus, Iwasaki et al. (US 6,838,297) in view of Urayama et al (US 6,650, 061) in view of Weinberg et al (US 6, 638,413) does not make obvious the use of Applicant's apparatus for the production of carbon nanoparticles having electrodes coated with catalytic nanoparticles of iron and nickel in a liquid hydrocarbon bath of methanol and benzyl alcohol with a power supply for application of DC voltage because Weinberg et al has an apparatus for the electrolysis of water; there is no discussion of the production of carbon nanoparticles, no discussion of the use of an organic electrolyte; no discussion of the use of catalyst coated electrodes; thus, no motivation for a person of ordinary skill in the art to rely on teachings in Weinberg et al.

As stated in the Federal Circuit in *In re Fritch*, 972F. 2d 1260, 23 USPQ2d 1780, 1784 (Fed. Cir. 1992) (quoting *In re Fine*, 837 F. 2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988)):

> "It is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the prior art so that the claimed invention is rendered obvious. This court has previously stated that "[o]ne cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention."

Applicant respectfully requests that the rejection of claim 8 under 35 U.S.C. 103(a) as unpatentable over Iwasaki et al et al. (U.S. Patent 6,838,297) in view of Urayama et al (U.S. Patent 6,650,061) in view of Weinberg et al (US 6, 638,413) be withdrawn.

Applicant reiterates the request to withdraw the rejection of Claim 9 under 35 U.S.C. 103(a) as being unpatentable over Iwasaki et al (US 6,838,297) in view of Urayama et al (US 6,650, 061) in view of Weinberg et al (US 6, 638,413) as applied to claim ~~[1]~~ 8 above, and further in view of Bell (US 4,310,393), since the claim is canceled, the rejection is now moot.

Likewise Applicant requests the withdrawal of the rejection of canceled Claims 13-17 under 35 U.S.C. 103(a) as being unpatentable over Iwasaki et al (US 6,838,297) in view of

Urayama et al (US 6,650, 061) in view of Weinberg et al (US 6, 638,413) in view of Bell (US 4,310,393); the rejection is now moot.

On page 7 of the Office Action of February 21, 2008, The Examiner responds to Applicant's arguments with respect to Claims 8 – 11, stating that the Applicant's arguments are moot in view of the new ground(s) of rejection citing "...Weinberg et al (US 6,638,413) was added to overcome the limitation of a direct current applying of 1000 volts." Applicant has responded to the new grounds or rejection based on the Weinberg et al reference above.

Applicant acknowledges the acceptance of the IDS filed 04 December 2007 as being compliant and will be made of record.

In paragraphs I. – VI on pages 8 and 9 of the Office Action of February 21, 2008, the Examiner responds to each of the Applicant's argument regarding claim 8, stating in I "...the functional language recited by Applicant does not impart further structure to the apparatus as claimed."

In II, "...structural limitations are met by modified Iwasaki et al..."; in III, "...whether organic or inorganic, does not impart further structure on the vessel/container."; in IV, "As to ambient conditions, it does not impart further structure to the vessel,..."; in V, "...citation was a typographical error."; in VI, "...Urayama et al was introduced for providing the conductive layer on the electrodes. Thus, the manner in which nanotubes are produced is irrelevant because the primary reference ... covers this limitation. ...the claimed invention is for an apparatus, the production of nanotubes is irrelevant so long as the limitations of the apparatus are available."

Therein lies the major problem with the Examiner's arguments. To state that the production of nanotubes is irrelevant is to miss the purpose of the invention. It was not known that an electrochemical deposition apparatus could produce carbon nanotubes if you coated the silicon wafer anode and silicon wafer cathode with catalytic particles situated in a liquid hydrocarbon bath to which direct current voltage could be applied. Applicant's apparatus was designed to produce commercial quantities of carbon nanoparticles in a low temperature, simple process capable of sustainable production capacity. Also with regard to functional language, *In re Echerd*, 176 USPQ 321 (CCPA, 1973) held that "There is nothing intrinsically wrong in defining something by what it does rather than by what it is."

Applicant's apparatus is an electrochemical cell with catalytically coated anode and electrode in a vessel containing an organic liquid that is required, to produce ***carbon nanotubes*** with the application of a direct current. The Examiner should not overlook the fact that a combination of known items can produce new and unexpected results.

For the first time, Applicant provides an electrochemical deposition apparatus for producing carbon nanoparticles in a vessel containing a liquid hydrocarbon with silicon wafer electrodes coated with catalytic nanoparticles of iron and nickel and a direct current power supply that can apply 1000 volts of direct current.

Paragraphs VII – IX on pages 10 and 11 of the Office Action of February 21, 2008 include the Examiner's counter-arguments to Applicants arguments regarding Claims 9, 10-11. These claims are canceled and the arguments for or against patentability are now moot.

The application and claims are believed in condition for allowance in the amended form; allowance of Claim 8 and new Claims 18 and 19 is respectfully requested. If the Examiner believes that an interview would be helpful, the Examiner is requested to contact the attorney at the below listed number.

Respectfully submitted,

Brian S. Steinberger
Registration No. 36,423
101 Brevard Avenue
Cocoa, Florida 32922
Telephone: (321) 633-5080

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